ABSTRACT

JOINT SFPE/NIST CONFERENCE
INTEGRATING FIRE RESEARCH INTO PRACTICE

SMITHSONIAN'S DULLES CENTER USING ADVANCED COMPUTER FIRE MODELING TECHNIQUES IN PERFORMANCE BASED DESIGN

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Fire protection in large facilities, especially those that are designed for special purposes, is a challenge because often conventional fire protection design techniques do not apply to these spaces. In many cases local building codes and standards are also not applicable since during the code development process the design of such atypical spaces was not anticipated. A good example of a large special purpose facility is the planned National Air and Space Museum Extension at Dulles International Airport.

NASM Dulles Center will consist of several large exhibit spaces for restored aircraft, including a retired Space Shuttle, industrial shop areas, archive storage, and a large format theater. Because this large building, over 1 million square feet, will function as a large assembly space, travel distance requirements of applicable building codes were a concern to the design team and building owner. Additionally, there was some question as to the need and effectivencss of smoke exhaust and/or smoke control systems for the space.

In order to address these design concerns, a computer model was used to aid in evaluating the effectiveness of various fire protection systems in the large open exhibit areas. This evaluation was done primarily to quantify the ability of occupants to egress the space safely in the event of a fire. The Large Eddy Simulation (LES) Fire Model being developed at NIST is a computational fluid dynamics code that solves the Navier-Stokes equations governing the transport of smoke and hot gases from a fire. The results of LES produce realistic simulations of various types of fire-related scenarios in large spaces.

The results of LES were used to evaluate the effect of a large unimpeded fire in the large semi-cylindrical NASM exhibit space. The results of this simulation demonstrated that based on the proposed exhibit materials and maximum anticipated occupant load, a large fire in the hall would permit ample egress time from the space for all occupants not in intimate contact with the fire's point of origin.

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